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10/787,298

02/27/2004

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EXAMINER

HAILU, KIBROM T

ART UNIT

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2616

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**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

# Office Action Summary

Application No.

10/787,298

Applicant(s)

JOUNG ET AL.

Examiner

Kibrom T. Hailu

Art Unit

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 16 October 2007.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1-17 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-17 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 27 February 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

## Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

## Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: \_\_\_\_\_

## **DETAILED ACTION**

### ***Response to Arguments***

1. Applicant's arguments received on October, 16 2007 have been fully considered but they are not persuasive because the cited references teach the rejected claims as set forth in the previous Office Action. The final rejections given below have been expanded to provide more detail on how the argued limitations are met by the references. Therefore, the finality of this Office Action is deemed proper.

**Regarding claim 1**, the Applicants argue that Lakshman doesn't disclose a field level tries structure, and is only disclose trie search according to bits of a source address. The Examiner respectfully disagrees. As clearly shown in fig. 9B, Lakshman discloses field level trie structure. It is a trie search by field (col. 9, lines 26-29), not grid-of-tries. The Applicants also argue that the Examiner concedes Lakshman does not teach a plurality of classification engine. With all due respect, the Examiner doesn't concede Lakshman doesn't disclose a plurality of classification. The Examiner simply said, "it is obvious or understood to have multiple forward engines in a network (router) for packet classification" (please, see col. 1, lines 13-16).

The Applicants assert that Lakshman doesn't disclose two classification parts, and doesn't perform queries or processes a prefix lookup represented by an IP address lookup. Furthermore, the Applicants argue Lakshman doesn't suggest second classification part for proceeding with packet classification by field based on the result of first classification in order to process range lookup belonging to the result. The Examiner disagrees with the Applicants assertion. Lakshman discloses two-stage classification algorithm (col. 9, lines 21-29; col. 14, lines 31-41). The first is restricted to have prefix specification while the second is allowed to

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have range specification involving range lookup. That is, the first part is a pre-processing algorithm performing a search based on prefix, and of course perform queries and prefix lookup as shown in table 1 (col. 5, lines 15-22, 28-33, 37-44; col. 9, lines 28-42; abstract, lines 1-6). Meaning, in the first part or dimension each of the prefix value matching the value of the packet is identified. Then, in the second part of classification algorithm each interval (range or prefix range) corresponding to or based on identified prefix values containing the value of the packet is retrieved, and processes the received packet using the field in accordance with the processed rules of the pre-processing algorithm (see col. 3, line 57-col. 4, line 2; col. 4, lines 4-17; col. 6, lines 6-22; col. 13, lines 18-29; claim 1). Note that the range nothing but interval.

**Regarding claim 4**, the Applicant argues that the cited reference (Lakshman in combination with Eatherton) do not teach TCAM. However, the memory CAM handles the searching of the stored fields (col. 12, lines 55-67), and Ternary CAM is a very well known memory for packet classification.

Therefore, the Applicants argument that lakshman doesn't disclose a two-stage or two-part classification is not persuasive.

### ***Claim Rejections - 35 USC § 102***

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claims 1-3, 8-10, 12-15 and 17 are rejected under 35 U.S.C. 102(b) as being anticipated by lakshman et al. (US 6,341,130 B1).

**Regarding claims 1, 13 and 14,** Lakshman discloses a packet classification apparatus using a field level tries structure (Fig. 9A and 9B), said apparatus comprising: a main processing part for generating and maintaining the field level tries structure, which organizes a multi-field packet by field in a hierarchical structure for classifications (Fig. 9B; col. 13, lines 15-48); and a plurality of classification engines (Fig. 10; col. 13, line 65-col. 14, line 4, “forward engine or router or hardware device 1000”, and it is obvious to have multiple forward engines in a network for packets classification), each classification engine (1000) provided with a first classification part (field processor 1035) for performing queries and updates (Fig. 10; col. 14, lines 8-9) and processing a prefix lookup represented by an IP address lookup (col. 7, lines 50-59; col. 4, lines 3-6; col. 13, lines 18-22), and a second classification part for proceeding with packet classification by field based on a result of the first classification part in order to process a range lookup belonging to the result (Fig. 9B; 9A; 3; 4; col. 13, lines 22-25, 40-48, 51-60).

**Regarding claim 2,** Lakshman discloses each classification engine (1000) includes a classification processor (classification or filter processor 1050) and a memory (1030) (Fig. 10; col. 14, lines 6-7).

**Regarding claim 3,** Lakshman discloses the main processing part (CPU) and the classification engines (forward engine or hardware device 1000) are connected through a broadcasting bus (CPU interface line 1010) (Fig. 10; col. 14, lines 1-4).

**Regarding claims 8 and 15,** Lakshman discloses the field level tries structure is organized as a structure wherein one or more fields of a first group appear in an upper level of the structure and one or more fields of a second group appear in a lower level of the structure (see Figs. 9A and 9B; col. 12, line 65-col. 13, line 60)

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**Regarding claims 9 and 10**, Lakshman discloses the fields of the first group are fields in a prefix format (Fig. 9B; col. 13, lines 18-22, 51-60); and the fields of the second group are fields in a range format (Fig. 9B; col. 13, lines 22-25, 53-60).

**Regarding claims 12 and 17**, Lakshman discloses in the field level tries structure, a level for the prefix lookup exists as only one level having a plurality of prefixes combined with each other (Fig. 9A and 9B; col. 12, line 65-14, 30-48).

### ***Claim Rejections - 35 USC § 103***

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

6. Claims 4, 11 and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lakshman in view of Eatherton et al. (US 6,560,610 B1).

**Regarding claim 4**, Lakshman discloses the first classification part of each classification engine stores fields of a prefix format (col. 15, lines 13-16; col. 4, lines 15-17; col. 9, lines 57-

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65; col. 10, lines 18-22). However, Lakshman doesn't explicitly disclose uses a ternary content addressable memory (TCAM) to search the stored fields.

Eatherton teaches a ternary content addressable memory (TCAM) to search the stored fields (col. 12, lines 55-60; col. 15, lines 13-18).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the TCAM of Eatherton for prefix field search into the classification apparatus of Lakshman so that the fields or the data structure can be searched quickly.

**Regarding claims 11 and 16**, Lakshman discloses multiple field level tries hierarchical structure in prefixes and range format (Figs. 9A and 9B). However, Lakshman doesn't explicitly disclose if two nodes in any level have a common child node, only one node, corresponding to the common child node, is generated and shared in the field level tries structure.

Eatherton teaches if two nodes in any level have a common child node, only one node (child arrays 66, 68 and 70), corresponding to the common child node, is generated and shared in the field level tries structure (Fig. 3; col. 5, lines 55-64).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use a child array or common node to share in the field level tries structure when having a common child as taught by Eatherton into the packet classification apparatus of Lakshman in order to facilitate a rapid search and minimize the storage requirement (Eatherton, col. 4, lines 7-8).

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7. Claims 5 and 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lakshman in view of Lampson (IP Lookups Using Multiway and Multicolumn Search, IEEE Vol. 7, No. 3, June 1999).

**Regarding claims 5 and 6**, Lakshman discloses the second classification part. However, Lakshman doesn't explicitly disclose it uses a k-way search scheme having an appropriate value k based on usage and specification; wherein the value k is determined based on a size of a memory interface of the second classification part.

Lampson discloses a k-way or multiway search scheme having an appropriate value k based on usage and specification (page 333, col. 2, lines 2-12, 14-15, 40-44); wherein the value k is determined based on a size of a memory interface of the second classification part (page 329, col. 1, lines 24-40).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use the k-way or multiway search scheme, wherein k depends on the memory size as taught by Lampson into the packet classification apparatus of Lakshman in order to obtain better measured performance.

8. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Lakshman in view of Bergantino et al. (US 6,798,778 B1).

**Regarding claim 7**, Lakshman discloses the main processing part (CPU) and classification engine (forward engine or hardware device 1000) are connected through bi-directional CPU interface line 1010 (corresponding to broadcasting bus), and the engine 1000 includes a memory 130. However, Lakshman fail to discloses changing the content of memory of the engine upon receipt of an update instruction from the processor or CPU.



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Bergantino teaches changing the content of memory of the engine upon receipt of an update instruction from the processor or CPU (col. 3, lines 2-5; col. 2, lines 33-40, 56-61).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made use the Bergantino's look-up engine that changes or modifies the memory content in response to the update instruction transferred by the processor into the packet classification apparatus of Lakshman so that the circuitry can operate at high speeds, and core processor capacity is freed up for other processing tasks (Bergantino, col. 2, lines 20-22).

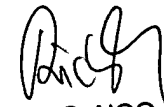
### *Conclusion*

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kibrom T. Hailu whose telephone number is (571)270-1209. The examiner can normally be reached on Monday-Thursday 8:30AM-6:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ricky Q. Ngo can be reached on (571)272-3139. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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